



Cape & Islands Renewable Energy Collaborative

Promoting a sustainable energy future

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Cape & Islands Energy Technology Strategy Project: Summary of Kickoff Workshop & Next Steps

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Overview

In November 2007, participants in the Cape & Islands Renewable Energy Collaborative (CI*Renew*) conducted the kickoff workshop for a project, "Renewable Generation & Electrification: Technology Strategy for the Carbon-Constrained Future," recently funded by the Electric Power Research Institute (EPRI). The project supports an ongoing "Beyond Cape Wind" community planning process—initiated in 2005 through CI*Renew*—that encompasses energy supply, delivery and use across all sectors as well as their impacts on security, climate, and well-being. The comprehensive nature, collaborative approach, and ambiguous name of this process have succeeded in bringing stakeholders to the table because *beyond* can mean *instead of* to wind project opponents and *in addition to* among other renewable energy advocates.

Throughout 2007, stakeholders worked together to craft a regional energy action plan (REAP) supporting collaborative pursuit of ambitious goals for the year 2020 (see box). The REAP, to be released in January 2008 as *CI GoGreen: Report to the Community and Call to Action*, includes both a collaborative action plan to be implemented by CI*Renew* participants and initial action plans to be implemented by residents and visitors, businesses and organizations, students and schools, agencies and officials, and communities. The initial plans are *qualitative*; the EPRI-funded project supports development of *quantitative* action plans by engaging stakeholders in helping chart the path forward for the Cape & Islands region across the energy technology spectrum and toward the 2020 goals.

2020 Goals

- Generate sufficient renewable energy in the Cape & Islands region to meet 100% of net electricity needs by 2020
- Reduce direct use of fossil fuel for heating and transport applications in the Cape & Islands region by 50% in 2020, relative to 2006 consumption

The project kickoff workshop was held at Woods Hole Research Center on November 15, 2007. It was attended by a total of 26 people with utility, government, research, technology, and advocacy perspectives. Attendees examined goals, technology priorities, and R&D needs previously defined by Cape & Islands stakeholders through a CI*Renew* Working Group that includes representatives from Cape & Islands Self-Reliance, Cape Cod Community College, Cape Clean Air/Clean Power Now, Nantucket Soundkeeper/Alliance to Protect Nantucket Sound, Woods Hole Research Center, and local businesses. Attendees also identified priority applications and site-specific opportunities and helped design a joint review process that will lead to development of a *Cape & Islands Energy Technology Strategy*. The kickoff workshop is summarized below, followed by a brief discussion of next steps. The agenda, invitation list, and meeting materials are attached, and presentations are available as separate documents.

Over the next several months, CI*Renew* participants will apply EPRI funding and tools for technical and economic assessment of energy options across roughly the next 2 decades. Research and review are to be conducted through the CI*Renew* Working Group in conjunction with consultants, EPRI staff, and stakeholders. The *Cape & Islands Energy Technology Strategy* is scheduled to be available in draft form in March 2008 for stakeholder review and comment, and it will be released to the public in late spring.

11/15 Presentation Summaries

John Holdren welcomed attendees and offered perspective on the need for massive technological change to mitigate emissions and reduce the suffering associated with climate change.

Tom Key focused on reducing the U.S. electric sector's carbon footprint. His "Electricity and Carbon Emissions: Role of Renewables" presentation reviewed seven broad technology areas identified by EPRI where aggressive progress is required to ensure that society's demand for reliable and affordable electricity can be met while restoring the sector's CO₂ emissions to 1990 levels by the 2030. Four areas – efficiency, renewables, distributed resources, and plug-in hybrids – are to be addressed by the *Cape & Islands Energy Technology Strategy*; the others – advanced nuclear, advanced coal, and carbon capture and storage – have previously been identified as "off the table" from a local deployment perspective. Tom's presentation concluded with a review of the cost-performance characteristics of current renewable generation options based on 2007 data from EPRI's *Technology Assessment Guide*TM, as well as an assessment of the development status and potential of emerging renewable energy technologies.

Walt Musial delivered his "Offshore Renewable Energy" presentation via speakerphone. He reviewed the worldwide resource base and current development activity, demonstrated the match between the U.S. offshore wind resource and major load centers, and reviewed offshore wind benefits and the barriers to

U.S. deployment. He then provided an in-depth review of offshore wind economics and the foundation design options for transitional and deepwater wind projects. Recent modeling results were described indicating that new blade designs will likely be required for turbines installed on floating platforms, and technology options for tidal and wave energy conversion were introduced. Walt ended his presentation with the conclusion that shallow-water experience and a fully funded domestic R&D program will be required to commercialize deepwater wind technology within the time period spanned by the *Cape & Islands Energy Technology Strategy*. He also noted that deepwater wind is not currently supported by federal R&D.

Project Kickoff Workshop Attendees

Megan Amsler, Cape & Islands Self-Reliance

Brad Bradshaw, Massachusetts Hydrogen Coalition

Nicole Brooks, Cape Cod National Seashore

Rich Claytor, Horsley Witten Group

Ken Ekstrom, Massachusetts Institute of Technology

Jan Gudell, NStar

Joe Hackler, Woods Hole Research Center

Whitney Hall, Waste Options

John Holdren, Woods Hole Research Center (partial)

Tom Key, Electric Power Research Institute

Chuck Kleekamp, Cape Clean Air/Clean Power Now

Austin Krcmarik, AmeriCorps Cape Cod

David Larson, National Grid

Richard Lawrence, Cape Cod Community College

John Miller, UMASS-Dartmouth Advanced Technology
Manufacturing Center

Walt Musial, U.S. National Renewable Energy Laboratory (partial)

Ben Pearson, Cape Cod National Seashore

Chris Powicki, Water Energy & Ecology Information Services

Herb Rice, Cotuit Solar

Mark Rodgers, Cape Wind

Charlie Salamone, Cape Power Systems

Clay Schofield, Cape Cod Commission

Bill Staby, Resolute Marine Energy

Tom Stone, Woods Hole Research Center

Bill Veno, Martha's Vineyard Commission

Andrew Vorce, Nantucket Planning & Economic Development
Commission

Chris Powicki reviewed points of consensus from the "Beyond Cape Wind" planning process and described the REAP developed through *CI Renew* over the past year to support pursuit of stakeholder-defined 2020 goals. In providing a detailed introduction to the EPRI-funded project, he indicated that the initial stakeholder REAPs are *qualitative*, that the *Cape & Islands Energy Technology Strategy* will provide the technical and economic data required to develop *quantitative* action plans consistent with the 2020 goals, and that these goals are extremely ambitious yet technically feasible. Chris concluded his presentation by summarizing technology evaluation activities to date through the *CI Renew* Technology Strategy Working Group.

Breakout & Group Discussions

To support further examination of energy technology priorities and R&D opportunities for the Cape & Islands region, three facilitated breakout groups were held, two addressing land-based applications and the third offshore energy development:

- *Fixing Buildings & Managing Demand*: Focus on approaches for greening existing structures and changing behavior (Megan Amsler & Herb Rice)
- *Growing Smart & Greening Infrastructure*: Focus on approaches for promoting sustainable development (Joe Hackler & Rich Claytor)
- *Moving Offshore & Delivering Back*: Focus on options for demonstrating and deploying wind, tidal, and wave energy systems (Chris Powicki & Richard Lawrence)

The breakouts were conducted using discussion prompts addressing technology and policy issues that had been developed based on previous stakeholder input were provided to breakout facilitators. Subsequently, a group discussion considered alternative financing and ownership models and existing and potential energy/climate policies to be addressed in this study.

Breakout and group discussion prompts and conclusions are summarized below in the form of applications, projects, and issues to be addressed during the course of follow-on analysis of energy supply, delivery, and use options. The two land-based breakout groups are combined because the solutions identified provide a comprehensive perspective on options for fixing existing buildings and systems and applying green approaches and technologies to support future construction and growth. The ocean energy breakout group not only defined the types of commercial installations, R&D projects, and test facilities to be examined, but also it identified specific sites and associated transmission system limitations.

Over the next couple months, each technology and measure listed below will be evaluated in light of its potential contribution to the 2020 goals under the varying ownership, financing, and policy structures listed below. Different project scopes and levels of penetration will be examined to determine the relative costs and benefits, including energy savings and emissions reductions, associated with specific deployment scenarios. In addition, conceptual designs will be developed for clean energy demonstration projects and ocean energy test facilities, including project scopes and estimates of requisite public-private investment commitments.

Fixing Buildings & Managing Demand/Growing Smart & Greening Infrastructure

- Building Envelope Upgrades
 - Weatherstripping & Thermal Sealing
 - Insulation
 - Windows
- Heating & Space Conditioning Upgrades
 - Programmable Thermostats
 - Heating & AC Unit Tuning
 - Retrocommissioning
 - Efficient & Green Replacements
- Electric End Uses
 - CFLs & Advanced Lighting
 - Appliances
 - Intelligrid Applications, Load-Control Strategies & Devices
- Solar Thermal
 - Solar Thermal DHW
 - Solar Thermal Coupled With Absorption Chiller for Space Conditioning
 - Solar Thermal Pool Heating
- Geothermal
 - With On-Site Renewables
 - Without On-Site Renewables
- Biofuels

- Heating
- Cogeneration
- Community & Neighborhood-Scale Wind
 - Residential
 - Commercial
 - Community-Based Installations for Martha's Vineyard to Replace Diesel Generation & Defer Transmission Investment
- PV
 - Residential
 - Commercial
- Bioenergy/Waste Management
 - Waste-to-Energy Projects on Martha's Vineyard and Nantucket
 - Advanced Technologies for Electricity/Fuel Production
- Water Supply & Wastewater Treatment Applications
 - Efficiency Applications
 - Renewables Applications – Wind, Digester Gas, etc.
- Clean Vehicles & Transit
 - Diesel & Biodiesel
 - Hybrids
 - Plug Hybrids
 - Ethanol

Demonstration Projects

- Landfill Gas Project at Bourne Landfill
- Distributed Generation, Renewables, Efficiency, and Smart Metering to Serve Load Growth & Avoid Transmission Investment
- Building-Integrated PV
- Cogeneration/District Heating in Growth Centers & Clustered Developments
- Renewable Generation to Plug Hybrid Infrastructure & Distributed Storage
- Renewable Hydrogen Demonstration

Moving Offshore & Delivering Back

- Community-Based Installations in State Waters
- Commercial Ocean Energy Projects in Federal Waters South of Tuckernuck, Off Cape Cod National Seashore, and Elsewhere
- Transmission Interconnections to Mainland Grid

Demonstration Project

- Long-Term Ocean Energy Test Site in Muskeget Channel & Adjacent Waters

Project Parameters & Limits

- Offshore Wind at All Depths: 10, 25, 50, 100, 250, 500, 1000 MW
- Test, Demonstration & Early Commercial Projects for Transitional/Deepwater Wind, Wave, Tidal & Hybrid Systems: 5 to 50 MW
- Interconnection Limits
 - 500 MW of Offshore Renewables Possible Without Need for Transmission Upgrade
 - Interconnection of 80 MW to Nantucket Possible
 - Interconnection of 60 MW to Martha's Vineyard Possible
 - Interconnection to Both Islands Feasible
 - Direct Tie to Mainland Grid Likely Most Economical
- Cable Options
 - AC Technology Viable to About 50 Miles; Nominal Limit of 400 MW Per Cable
 - DC Technology Much More Effective After That; Nominal Limit of 600 MW Per Cable
 - High-Temperature Superconducting Cable Represents Possible R&D Opportunity

Ownership, Financing, Policy & Incentive Issues

- Effects of Ownership & Financing Models
 - Larger Supply-Side Projects: Municipal Utility, Cooperative, Investor-Owned Utility, Independent Power Producer, Hybrids
 - Smaller Consumer-Side Projects: Individual Ownership; Municipal Property Tax/Bond Financing, Revolving Fund; Cooperative or Aggregation Models; Performance Contracting; Third-Party/Utility Ownership
- Effects of Existing/Possible Local, Regional, State & Federal Policies, Incentives & Revenue Streams
 - Values of RECs, Carbon Prices/Offsets & FCM Services
 - Inverted Block Rate Pricing, Decoupling & Least-Cost Procurement
 - Feed-In Tariffs & Net/Virtual Metering
 - Transmission Tariffs & Responsibilities
 - Federal Legislation – PTC, ITC, Loan Guarantees, R&D Allocations/Credits, etc.
 - Green Communities Act – RPS, APS, Ratepayer Funds, Community Actions, Statewide Goals, etc.
 - Revenues from RGGI Auctions, Alternative RPS Compliance Penalties & Forward Capacity Market Activity
- Effects of Enhanced Audits & Updated Codes With Residential/Commercial Differentiation
 - Requirement for Comprehensive Audits (Air Sealing, Solar, etc.)
 - Energy Audits at Point of Sale (Like Title V): Phase In Requirement Over Time (e.g., 2009 require audits only; 2012 replace inefficient appliances; 2020 full performance)
 - New Construction: Passive Solar Design; Green Communities Act Code Requirements; Beyond-Code Envelope; Phase In Requirement for On-Site/Clean Energy (e.g., 10% by 2010, 30% by 2020); GIZ/DRI Incentives & Offsets for Smart Siting & Green Building

Next Steps

The workshop ended with group discussion addressing follow-on data collection, analysis and modeling, review, and communications stages of the *Cape & Islands Energy Technology Strategy* project.

To measure progress toward the 2020 goals, an inventory is required to set current baselines, and projections of future consumption and prices are needed to model future scenarios. Consumption, efficiency, delivery, and production data are to be requested from centralized data sources including NStar, Keyspan, Cape Light Compact, National Grid, Massachusetts Technology Collaborative, and state agencies. Consumption and commodity cost projections are to be based on forecasts and scenarios developed by the U.S. Energy Information Agency, ISO-New England, utility, EPRI, and other sources.

To evaluate the technical and economic potential of energy supply, delivery, and use options under varying scenarios of the future, cost-performance data and projections are required, as are modeling tools. The latest publicly available information on electricity-based technologies from EPRI's *Technology Assessment Guide*[™] will be used, and additional data and projections will be collected from other credible sources. EPRI's National Electric System Simulation Integrated Evaluator (NESSIE) model will be applied to simulate electric sector technology choices, system operations, and emissions within the ISO-NE control region, and additional tools will be applied to examine the economic and environmental implications of technologies, applications, and demonstration projects.

Initial findings from these analyses will be summarized and communicated to stakeholders for review and comment in March 2008, followed by public release of a draft *Cape & Islands Energy Technology Strategy* detailing options, tradeoffs, and recommendations for achieving the 2020 goals.

Cape & Islands Energy Technology Strategy Workshop

8:30 am – 1 pm, November 15, 2007

Woods Hole Research Center, 149 Woods Hole Road, Falmouth



Agenda

Registration (8:30 – 9:00)

Welcome & Introductions (9:00 – 9:20)

John Holdren, WHRC

- Need for energy transformation to address climate change and other drivers shaping the future

Energy Technology, Electrification & Climate Stabilization (9:20 – 10:00)

Tom Key, EPRI; and Walt Musial, NREL

- Conclusions from technology assessments and modeling analyses conducted by the Global Energy Technology Strategy Project, EPRI, and the U.S. National Renewable Energy Laboratory

Cape & Islands Energy Technology Strategy Project (10:00 – 10:30)

Chris Powicki, WEEinfo/CIRenew

- “Beyond Cape Wind” conclusions and goals; project outline; technology priorities and RDD&D needs

Break (10:30 – 10:45)

Breakout Discussions (10:45 – 11:30)

- Fixing Buildings & Managing Demand
- Growing Smart & Greening Infrastructure
- Moving Offshore & Delivering Back

Group Discussion (11:30 – 12:15)

- Analysis Variables: Policy, Pricing, Ownership, etc.
- Next Steps: Plans for conceptual design and analysis of specific technology applications and opportunities and for development of the comprehensive technology strategy

Lunch & Informal Discussion (12:15 – 1:00)

List of Invitees

- **Utility:** Cape Light Compact, ISO-NE, Keyspan, National Grid, NStar
- **State/Federal Government:** Cape Cod National Seashore, Massachusetts Division of Energy Resources, Massachusetts Executive Office of Energy & Environmental Affairs, Massachusetts Technology Collaborative, Office of Rep. William Delahunt, U.S. National Renewable Energy Laboratory
- **Academia:** Massachusetts Institute of Technology, University of Massachusetts – Amherst Renewable Energy Research Laboratory, Woods Hole Research Center, University of Massachusetts – Dartmouth Advanced Technology & Manufacturing Center
- **Clean Energy:** American Superconductor, Cape Wind, Cotuit Solar, Evergreen Solar, Horsley Witten Group, Konarka Technologies, Massachusetts Hydrogen Coalition, Nelson Mechanical Design, Resolute Marine Energy, Waste Options, Water Energy & Ecology Information Services
- **Local/Regional:** Cape & Islands Self-Reliance, Cape Cod Commission, Clean Power Now, Martha's Vineyard Commission, Nantucket Planning & Economic Development Commission, Alliance to Protect Nantucket Sound/Nantucket Soundkeeper

CIREC Technology Strategy Working Group Members

Megan Amsler (Self-Reliance), **Kevin Galligan** (Cape Light Compact), **Joe Hackler** (Woods Hole Research Center), **Nate Kelly** (Horsley Witten Group), **Chuck Kleekamp** (Clean Power Now), **Richard Lawrence** (Cape Cod Community College), **Chris Powicki** (WEEinfo) & **Sue Nickerson** (Alliance to Protect Nantucket Sound/Nantucket Soundkeeper)

Prompts for Breakout Sessions, Technology Strategy Workshop, 11/15/07

Fixing Buildings & Managing Demand

- CFLs and other advanced lighting – How many per home? What percentage of commercial buildings should be retrofit with advanced lighting? What's on the horizon?
- Programmable Thermostats – Any reason not to have a goal of having these in every building?
- Building Envelope (upgrade air sealing and insulation) – What incentives are needed to spur action on existing buildings?
- Heating Plant (replace and resize) – What should be installed? (Gas, Oil/Bio, Cogen?)
- Solar Thermal – What percentage of existing/new pools should have solar thermal? How about homes? Others? What segments to target?
- Geothermal – Is this a viable retrofit option? Should it be encouraged in the absence of on-site renewable power for the pumping system?
- Clean Vehicles – How should consumers and communities invest in efficiency and renewables? (Diesel, hybrid, plug hybrids, etc.)
- Consumer-Side PV and Wind – What are realistic penetration targets?
- Pricing – Will real-time pricing reduce demand or shift it? Is inverted block rate pricing a better way?
- Incentives – What is the best way to encourage action? Loans? Rebates? Tax breaks?

Growing Smart & Greening Infrastructure

- Green Building Codes & Standards – How tough? What's required? (Require passive solar design, beyond-code envelope, life-cycle cost analysis of supply, delivery, and use options?)
- Energy Enterprise Zones – How can we incentivize commercial investment in distributed energy infrastructure? What should we encourage?
- Consumer-Side & Distributed Renewables (PV, Wind, Solar Thermal, Geothermal) – What are realistic penetration targets?
- Building-Integrated PV – What do we want to learn from a demonstration project? What projects should be encouraged?
- Heating – What are preferred options? (Solar thermal, geothermal, biofuel, gas, oil?)
- Cogeneration – Gas or biofuel? What should a renewable hydrogen/fuel cell demonstration entail? When is one appropriate?
- District Heating – Should we plan a demonstration project?
- Intelligrid Applications – Should we plan for smart metering? Controllable end uses? DC microgrids?
- Transit – What options should we be supporting now? In the future? (Biodiesel, plug hybrid, ethanol, hydrogen)
- Plug Hybrids – What should a renewable generation/plug-in hybrid/mobile storage system look like?
- Hydrogen – When would demonstration of hydrogen fuel cell vehicle/renewable generation system be appropriate?
- Waste to Energy – What's the best path to resource recovery and cost reduction?
- Wastewater Treatment – What are the energy-related opportunities?

Moving Offshore & Delivering Back

- Wind in State, Shallow, and Transitional Waters: Are community-based projects conceivable? How small is too small? How big is too big?
- Pilot Installation and Plug-and-Play Test Facility for Tidal, Transitional/Deepwater Wind & Wave Energy: South of Tuckernuck?
- Commercial Deepwater Development: Should the Outer Cape be off limits? How big is possible?
- Interconnection: How much offshore capacity could the existing system handle? What cabling options should be explored? (AC, DC, HTS?) What upgrades will be needed for a big project?
- Stakeholder-Based Ocean Zoning – Can we jumpstart this process now with state/federal support?